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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/745,301	12/22/2000	Anand Kannan	05245.00001	6994

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EXAMINER	
BAYARD, EMMANUEL	
ART UNIT	**PAPER NUMBER**
2638	

DATE MAILED: 06/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/745,301	KANNAN ET AL.	
	Examiner	Art Unit	
	Emmanuel Bayard	2638	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) *1-15* is/are allowed.

6)☒ Claim(s) *16-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This is in response to amendment filed on 4/6/05 in which claims 1-33 are pending. The applicant's amendments have been fully considered but they are moot based on the new ground of rejection.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claim 16-22 and 28-33 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim US Patent No 5,963,592 .

As per claims 16 and 28, kim teaches A method for error reduction in an orthogonal modulation communication system comprising steps of: determining an equalization function that is capable of reducing a multi-path delay of a received signal that comprises a plurality of orthogonal sub-carriers (see col.1, lines 39-45 and col.2, lines 2-15) and reducing a delay of the received signal based on the computed equalization function (see col.2, lines 2-15).

As per claims 17 and 29 Kim teaches wherein the step of determining an equalization function comprises steps of: determining a channel transfer function (see col.2, line 33-40); determining a desired composite communication channel transfer

function (see col.2, lines 33-65) ; and determining an equalization function that is based on the determined channel transfer function and the desired composite communication channel transfer function and that reduces a multi path delay of a received signal (see col.1, lines 39-45 and col.2, lines 2-15).

As per claims 18 and 30, Kim teaches wherein a convolution of the equalization function with the estimated channel transfer function produces a desired composite communication channel transfer function that comprises a predetermined multi-path delay (see col.1, lines 39-45 and col.2, lines 2-65).

As per claims 19 and 31, Kim teaches, wherein the determined channel transfer function comprises a greater multi path delay than the predetermined multi path delay of the desired composite communication channel transfer function (see col.1, lines 39-45 and col.2, lines 2-65).

As per claims 20 and 32, Kim teaches wherein the step of determining an equalization function comprises a step of determining a plurality of equalization functions that are based on the determined channel transfer function and the desired composite communication channel transfer function that together reduce a multi path delay of the received signal (see col.1, lines 39-45 and col.2, lines 2-65).

As per claims 21 and 33, Kim teaches wherein the step of determining a plurality of equalization functions comprises steps of: determining a plurality of composite equalization functions, wherein each composite equalization function of the plurality of composite equalization functions comprises a plurality of equalization functions that together reduce a multi path delay of the received signal (see col.1, lines 39-45 and

col.2, lines 2-65); determining an optimal composite equalization function from among the plurality of composite equalization functions; and determining a plurality of equalization functions based on the determination of an optimal composite equalization function (see col.1, lines 39-45 and col.2, lines 2-65).

As per claim 22, Kim inherently teaches, wherein the step of determining an optimal composite equalization function comprises steps of: for each composite equalization function of the plurality of composite equalization functions, determining a signal-to-noise ratio ISNR) for at least one sub-carrier of an orthogonal frequency division multiplex signal to produce determined SNR's; for each composite equalization function of the plurality of composite equalization functions, determining a minimum SNR from among the determined SNR's; determining a maximum SNR from among the minimum SNR's determined for each composite equalization function of the plurality of composite equalization functions to produce a determined maximum SNR; and determining an optimal composite equalization function based on the composite equalization function corresponding to the determined maximum SNR.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 23-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frodigh et al U.S. patent No 5,726,978 in view of Sayeed U.S. patent No 6,456,653 B1.

As per claims 23, 28 Frodigh et al discloses a communication device comprising: a receiver that receives a signal that comprises a plurality of orthogonal sub carriers (see figs 3a, 3c element 330 and col.4, lines 30-50 and col.8, lines 38-44); a signal processing unit coupled to the receiver that receives the plurality of orthogonal sub carriers from the receiver (see fig. 3a element 360), determines a signal quality metric for each subcarrier of the plurality of orthogonal sub carriers, and determines subcarrier suppression information based on the determined signal quality metrics (see abstract and col.4, lines 50-67 and col.8, lines 59-63 and col.16, lines 27-30); and a transmitter (see fig.3a element 300) coupled to the signal processing unit that receives the subcarrier suppression information from the signal processing unit and transmits the received subcarrier suppression information.

However Frodigh does not teach removes guard band interval

Sayeed teaches removes a guard interval is the same as the claimed (guard band interval) (see figs. 2-3 element 210, 310 and col.5, lines 20-25, 43-45).

It would have been obvious to one of ordinary skill in the art to implement the teaching of Sayeed into Frodigh as to quickly and accurately estimate the signal-to noise ratio of the multicarrier signal and further minimize the inter-symbol interference as taught by Sayeed (see col.3, lines 33-35).

As per claim 24, Frodigh does teach the subcarrier suppression information comprises the determined signal quality metrics (see col.8, lines 59-63).

As per claim 25, Frodigh et al and Sayeed in combination would include a memory associated with the signal processing unit that stores a signal quality metric

threshold, wherein the signal processing unit further retrieves the signal quality metric threshold from the memory and compares at least one determined signal quality metric to the signal quality metric threshold to produce a comparison, and wherein the subcarrier suppression information comprises the comparison to accurately perform both channel estimation and symbol timing and carrier frequency offset estimation of different pilots symbols.

As per claim 26, Frodigh et al teaches (Previously Presented) In a communication system comprising an orthogonal modulation scheme wherein user information is modulated onto a plurality of orthogonal sub-carriers, a communication device comprising: a receiver that receives a signal comprising sub-carrier suppression information (see figs 3a, 3c element 330 and col.4, lines 30-50 and col.8, lines 38-44), wherein the sub-carrier suppression information is based on a plurality of signal quality metrics (see abstract and col.4, lines 50-67 and col.8, lines 59-63 and col.16, lines 27-30) determined for each orthogonal sub-carrier of the plurality of orthogonal sub-carriers; a signal processing unit coupled to the receiver(see fig. 3a element 360), that receives the sub-carrier suppression information, suppresses at least one orthogonal sub-carrier of the plurality of orthogonal sub-carriers based on the sub-carrier suppression information to produce a suppressed orthogonal sub-carrier, receives data sourced by a data source, modulates the data onto a non-suppressed orthogonal sub-carrier of the plurality of orthogonal sub-carriers to produce a modulated non-suppressed orthogonal sub-carrier; and a transmitter coupled to the signal processing

unit that transmits the modulated non-suppressed orthogonal sub-carrier (see fig.3a element 300).

However Frodigh doe not teaches a transmitter coupled to the signal-processing unit that transmits the modulated and that inserts a guard band interval to ameliorate inter-symbol interference.

Sayeed teaches a transmitter coupled to the signal-processing unit that transmits the modulated and that inserts a guard band interval to ameliorate inter-symbol interference (see col.3, lines 33-35).

It would have been obvious to one of ordinary skill in the art to implement the teaching of Sayeed into Frodigh as to quickly and accurately estimate the signal-to noise ratio of the multicarrier signal and further minimize the inter-symbol interference as taught by Sayeed (see col.3, lines 33-35).

As per claim 27, Frodigh et al and Sayeed in combination would include the signal processing unit modulates the data onto each orthogonal subcarrier of the plurality of orthogonal sub carriers prior to suppressing the at least one orthogonal subcarrier to accurately perform both channel estimation and symbol timing and carrier frequency offset estimation of different pilots symbols to accurately perform both channel estimation and symbol timing and carrier frequency offset estimation of different pilots symbols.

As per claim 29, Frodigh et al and Sayeed in combination would include the determination of an equalization function by the signal processing unit comprises determining a desired composite communication channel transfer function and

determining an equalization function based on the communication channel transfer function and the desired composite communication channel transfer function to accurately perform both channel estimation and symbol timing and carrier frequency offset estimation of different pilots symbols.

As per claim 30, Frodigh et al and Sayeed in combination would include the signal comprising a plurality of orthogonal sub carriers comprises a first signal, wherein the receiver further receives a second signal comprising a plurality of orthogonal sub carriers, wherein the signal processing unit determines subcarrier suppression information based on the plurality of orthogonal sub carriers included in the first signal and conveys the determined subcarrier suppression information to a transmitter coupled to the signal processing unit, and wherein the transmitter transmits the subcarrier suppression information to accurately perform both channel estimation and symbol timing and carrier frequency offset estimation of different pilots symbols.

As per claim 31, Frodigh et al and Sayeed in combination would include wherein the communication device further comprises a plurality of antennas, wherein the reception by the receiver of a signal comprises receiving a transmitted signal via each antenna of the plurality of antennas to produce a plurality of received signals, wherein the transmitted signal comprises a plurality of orthogonal sub carriers, wherein a determination of an equalization function by the signal processing unit comprises a determination of a plurality of equalization functions based on a determination of at least one communication channel transfer function, wherein the plurality of equalization functions together reduce a multipath delay of the transmitted signal when the multipath

delay exceeds a tolerable multipath delay, and wherein a processing of the signal by the signal processing unit comprises processing each received signal based on a determined equalization function of the plurality of determined equalization functions to accurately perform both channel estimation and symbol timing and carrier frequency offset estimation of different pilots symbols.

As per claim 32, Frodigh et al and Sayeed in combination would include the determination of a plurality of equalization functions comprises determining a plurality of composite equalization functions, wherein each composite equalization function of the plurality of composite equalization functions comprises a plurality of equalization functions that together reduce a multipath delay of the transmitted signal, determining an optimal composite equalization function from among the plurality of composite equalization functions, and determining a plurality of equalization functions based on the determination of an optimal composite equalization function to accurately perform both channel estimation and symbol timing and carrier frequency offset estimation of different pilots symbols.

As per claim 33, Frodigh et al and Sayeed in combination would include the determination of an optimal composite equalization function comprises determining, for each composite equalization function of the plurality of composite equalization functions, a signal-to-noise ratio (SNR) for at least one subcarrier of a signal received by the communication device to produce determined Sir's, determining, for each composite equalization function of the plurality of composite equalization functions, a minimum SNR from among the determined Sir's, determining a maximum SNR from

among the minimum Sir's determined for each composite equalization function of the plurality of composite equalization functions to produce a determined maximum SNR, and determining an optimal composite equalization function based on the composite equalization function corresponding to the determined maximum SNR to accurately perform both channel estimation and symbol timing and carrier frequency offset estimation of different pilots symbols.

Allowable Subject Matter

3. Claims 1-15 are allowed over the prior art of record.

4. The following is a statement of reasons for the indication of allowable subject matter: suppressing, by the second communication device, an orthogonal subcarrier of the plurality of orthogonal sub-carriers based on the received subcarrier suppression information to produce a suppressed subcarrier and a non-suppressed subcarrier as recited in claims 1 and 12.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Park et al U.S. Patent No 6,470,030 B1 teaches an orthogonal frequency division.

Kim U.S. Patent No 6,098,161 teaches a method of generating address of coefficient.

Takeuchi U.S. Patent No 6,408,038 B1 teaches a receiver.

Belotserkovsky et al U.S. Patent no 6,650,617 B1 teaches a reduced complexity FFt.

Belotserkovsky et al U.S. Patent no 6,771,591 B1 teaches a method and system for processing orthogonal frequency division.

Gu US Pub No 2002/0085651 A1 teaches a removing frequency and timing.

Crawford U.S. Patent No 6,6650,616 B2 teaches a transmission security.

Wahlqvist et al U.S. Patent No 6,088,398 teaches an orthogonal frequency division.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Emmanuel Bayard whose telephone number is 571 272 3016. The examiner can normally be reached on Monday-Friday (7:Am-4:30PM) Alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vanderpuye Kenneth can be reached on 571 272 3078. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Emmanuel Bayard
Primary Examiner
Art Unit 2638

6/20/05

EMMANUEL BAYARD
PRIMARY EXAMINER